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# IMPACT OF IBA ON GROWTH AND DRY MATTER PARTITIONING OF AIR-LAYERS IN ANNUAL MORINGA CV. PKM-1

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## ABSTRACT

Moringa or drumstick tree or ben tree is native to northwestern India. Its classified to annual and perennial moringa. Limb cutting is followed in perennial types however, seed is the only source for annual types. Maintenance of genetic purity is one of the major breeding objectives in this cross pollinated commercial crop. Hence, asexual propagation method *viz*., air layering was carried out in Cv.PKM-1 and to study the effect of IBA on morphological traits of the layers. The experiment was carried out in randomized block design with five replications and four treatments (IBA 500, 1000 and 1500 ppm) and control along with coco-peat as media. Sustained results were obtained with application of 1500ppm IBA, which increased the root length(16.44cm), root fresh weight (2.96g), root dry weight (1.88g), dry matter content of root (63.41%), fresh weight of shoot (9.64), dry weight of shoot (6.41), dry matter content of shoot (66.60%), fresh shoot to root ratio (3.23). From the above study, air layering along with 1500 ppm IBA increased the root and shoot characters of annual moringa Cv PKM-1.

**KEYWORDS:** Moringa, Air Layering, IBA, Coco Peat, DMC of Root and Shoot, Shoot to Root Ratio

## INTRODUCTION

Moringa oleifera Lam., a multipurpose tree native to the foothills of the Himalayas in northwestern India is the most popularly cultivated crop of south India. In the South Asian native range of drumstick tree, annual temperature fluctuations tend to be large, with minimum and maximum shade temperatures ranging from –1 to 3 °C and 38 to 48 °C during the coldest and warmest months, respectively (Troup, 1921). It grows at elevations from sea level to 1400 m along the larger rivers of its native range on sandy or gravelly alluvium (Booth and Wickens, 1988). It is cultivated and has become naturalized in other parts of Pakistan, India, and Nepal, as well as in Afghanistan, Bangladesh, Sri Lanka, Southeast Asia, West Asia, the Arabian peninsula, East and West Africa, throughout the West Indies and southern Florida, in Central and South America from Mexico to Peru, as well as in Brazil and Paraguay (Little and Wadsworth, 1964; Ramachandran et al., 1980; Francis and Liogier, 1991 and Lahjie and Siebert, 1987). Parrotta (2001) reported that drumstick tree is indigenous to the Himalayan foothills of South Asia from northeastern Pakistan (33 °N, 73 °E) to northern West Bengal State in India and northeastern Bangladesh where it is commonly found from sea level to 1,400 m on recent alluvial land or near riverbeds and streams.

There are several vegetative methods for multiplication of the quality stock in forest tree species but air layering is often used as a method of propagation where the formation of roots from cuttings is slow (Hartmann and Kester, 1975). Air layering is the most convenient method of propagating litchi plants in our country (Bose and Mitra, 1990). The absence of easy and reliable clonal propagation method limits large scale cultivation of promising varieties and use of modern techiniques like micropropagation has not proved very successful in litchi (Amin *et al*. 1996). Air layering technique has been successfully used to propagate some of the most recalcitrant forestry species such as *Anogeis suspendula* (Gupta *et al*., 1997) and *Albizia procera* (Ansari *et al*., 1998). Air-layering constitutes the vegetative propagation process with higher success in cashew (Azam-Ali and Judge, 2001)**.** Exogenous application of auxin-type growth regulators can speed up the rooting process in air layers (Rahman *et al.*, 2000; Naz and Aslam, 2003). Guava is propagated on seedlings raised from open pollinated seeds which results in considerable variation in the size, shape, form and quality of fruits (Zamir et al., 2003) and evidently take longer time to reach to bearing stage when compared to vegetative propagated materials. Intact shoots (with leaves) possibly synthesize some unknown auxillary substances which help in induction of adventitious roots (Singh *et al.*, 2004). Among the vegetative methods of guava propagation, air layering with the help of growth substances is a successful method of propagation in guava (Tyagi and Patel, 2004). In addition the absence of light in the area of root formation, use of substrates to provide continuous moisture, and moderate temperatures are factors that favor rooting in the girdling zone (Ramirez-Villalobos and Urdaneta-Fernández 2004). In the modern times air layering propagation techniques using growth regulators during rainy seasons are being used to achieve more success. The rooting media like sand, soil, saw dust, moss grass (Kumar and Syamal, 2005), poultry manure, Vermicompost and farmyard manure (Singh et al., 2007) etc., are being used to improve the scope of air layering in guava. Sivaci and Yalcin (2008) also indicated that temperature was one of the factors that affected the seasonal changes of some important endogenous growth regulators in apples. Air layering technique is successful in propagating plants because the layered branch is not separated from the mother plant and therefore, receives continuous supply of water and mineral nutrients through the xylem and remains alive (Hartmann et al. 2010). The effects of air layers, coco peat and IBA on morphological traits of annual moringa are to be evaluated and hence the study was initiated to study the root and shoot characters of air layers.

## MATERIALS AND METHODS

The study on Moringa asexual propagation was carried out at mini orchard department of Horticulture, Agriculture College and Research Institute, Madurai during 2014-2015 located 9˚54′N latitude and 78˚50′E longitude at an elevation of 147 M above mean sea level. Three different treatments of IBA *viz.*, $T_1$-500, $T_2$- 1000 and $T_3$- 1500 ppm and $T_4$- control without IBA. In all the treatments, coir pith alone was used as media for air layering. One year old mother plants of annual moringa Cv. PKM-1 were selected from the mini orchard. Various morphological traits *viz.*, root length, root fresh weight, root dry weight, dry matter content of root, fresh weight of shoot, dry weight of shoot, dry matter content of shoot, fresh shoot to root ratio were studied. Standard method of air layering was done (Kumar, 2010). Ten plants were tagged in each treatment for recording observations. The data were statistically analysed and interpreted as suggested by Gomez and Gomez (1984)**.**

## RESULTS AND DISCUSSIONS

There were significant differences among the treatments under study in root length and presented in Table 1. The treatment $T_3$ (IBA 1500ppm) recorded higher root length of 16.44 cm which was significantly different from other treatments and least in Control, $T_4$ (6.08cm). Two treatments exceeded the grand mean on 10.82cm. The length of the root

increased with increase in the IBA concentration. In the present study, the air layers treated with IBA 1500ppm expressed nearly threefold increase in the length of the root, indicating the requirement of auxin to trigger the internal auxin level at the griddled portion. And also, the redifferentiation of roots at the griddled area occurred much earlier than the control, which indicates that the accumulation of nutrients at the girdled site would have increased the length of the root in the best treatment. Hwang (2005) also reported that, the application of Indole acetic acid at 2 mg $l^{-1}$ concentration significantly increased root lengths and the frequency of lateral roots in root clones of *Rehmannia glutinosa*. Rooting of the layered shoots was better in number and in the length of the roots with the application of 10,000 ppm of IBA as compared to the 5000 ppm and control as reported by Yeboah *et al*., 2009a, 2009b, 2010a and 2010b.

The higher root fresh weight *i.e*. 2.96g was recorded in $T_3$ (IBA 1500 ppm) followed by $T_2$ (IBA 1000ppm) with 2.02g and lower in $T_4$ (1.02g). The treatment $T_3$ was significantly different from other treatments. The root dry weight ranged between 1.88 g in plants treated with IBA 1500ppm to 0.38 g in control (Table 1). The treatment with IBA 1500ppm was significantly different from other genotypes. Two treatments exceeded the grand mean of 1.15g. There were significant differences among the treatments for root fresh and dry weight. The layers treated with IBA 1500ppm increased both the traits by 34% and 20% for fresh root and dry root weight respectively than the control. Hutcheon et al .(1973) also observed that, the presence of moisture in a media reduced plant stress and enhanced biochemical and physiological functions leading to enhanced metabolic activities during the rooting process. Auxins also stimulate secondary growth in the vascular cambium, induce the formation of adventitious roots. Further, the high moisture content of the media provided a regime for efficient functioning of microorganisms that were involved in organic matter decomposition of the media and release of nutrients. Akhtar et al. (2015) reported that, IBA, 450 ppm concentration produced maximum shoot length (10.67 cm), shoot dry weight (3.02 g), number of roots (14.00), root length (11.90 cm) and root dry weight (0.50 g) in rose.

**Table 1: Effect of Different Treatments on Root Characters of Moringa Saplings**

| Treatment | RL (cm) | RFW (g) | RDW (g) | DMC (%) |
|---|---|---|---|---|
| $T_1$- IBA 500 | 9.32 | 1.52 | 0.74 | 48.77 |
| $T_2$- IBA 1000 | 11.44 | 2.02 | 1.20 | 59.42 |
| $T_3$ – IBA 1500 | 16.44* | 2.96* | 1.88* | 63.41* |
| $T_4$- Control | 6.08 | 1.02 | 0.38 | 36.95 |
| Mean | 10.82 | 1.88 | 1.15 | 52.14 |
| C.D. (0.05) | 0.70 | 0.13 | 0.07 | 0.045 |
| SE.d | 0.32 | 0.06 | 0.03 | 0.018 |

**RL**- root length; **RFW**- Root fresh weight; **RDW**- Root Dry weight; **DMC**- Dry matter content of root.

The dry matter content varied from 63.41 to 36.95%. The higher DMC was recorded in $T_3$ and lower in $T_4$ (Table 1.). Three genotypes exceeded the grand mean of 52.14%. The treatment $T_4$ (IBA 1500ppm) was significantly different from other treatments. In this experiment, the root dry matter content was 58.21% higher than the control. Peres *et al*. (2001) also reported that the genotype directed 60% of dry matter towards the root system showed a 20-fold higher auxin accumulation in those organs. Air layering technique is successful in propagating plants because, the layered branch is not separated from the mother plant and therefore, receives continuous supply of water and mineral nutrients through the xylem and remains alive (Hartmann *et al*., 2010) and intact shoots (with leaves) possibly synthesize some unknown auxillary substances which help in induction of adventitious roots (Singh *et al.*, 2004).

There was significant difference between the treatments for fresh weight of shoots in Moringa (Table 2). The fresh weight of the shoots varied from 9.64g to 1.73 g. The treatment $T_3$ recorded higher new flush while the treatment $T_4$ had lower new flush. The treatment $T_3$ was significantly different from other treatments. There was nearly 3.5 fold increase in development of fresh shoot as compared to the control. The quicker growth of new shoots was observed in the treatment with IAB 1500ppm, which might be attributed by the earlier growth of the root system and formation of xylem vessels. The uptake of nutrients from the coco peat media could have increased the accumulation followed by synthesis of phytochemicals at the emerging site. Mortensen and Gislerod (1990) also reported that, the plants exposed to high relative humidity might show increased growth due to higher stomatal opening, leading to increased uptake of $CO_2$. And also Savithri and Khan (1994) opined that, composted coir pith has been recommended for the use as an amendment and can serve as a substitute for farm yard manure and other organic manures.

It was observed that, there were significant differences between the treatments for dry weight of shoots in the experiment. The dry weight of the shoots varied from 6.41 g to 0.88 g. The treatment $T_3$ recorded higher dry weight while the treatment $T_4$ had lower dry weight of newly emerged shoots. Two treatments exceeded the grand mean of 3.24g. The results are in coordination with the findings of Pratima and Rana (2011), where best shoot characteristics *viz.,* fresh weight of shoots (18.0 g) and dry weight of shoots per cutting (4.6 g) were recorded with blanching, girdling and IBA @ 5000 ppm treatment in kiwi cuttings. Hammo *et al.* (2013) also reported that, 2000ppm of IBA applied to Frasers photinia cuttings, significantly increased the shoot dry weight.

**Table 2: Effect of Different Treatments on Shoot Characters of Moringa Saplings**

| Treatment | FWS (g) | DWS (g) | DMC (%) | FSRR |
|---|---|---|---|---|
| $T_1$ - IBA 500 | 3.57 | 2.07 | 57.92 | 2.35 |
| $T_2$- IBA 1000 | 5.62 | 3.59 | 63.91 | 2.79 |
| $T_3$ – IBA 1500 | 9.64* | 6.41* | 66.50* | 3.23* |
| $T_4$- Control | 1.73 | 0.88 | 51.02 | 1.71 |
| Mean | 5.14 | 3.24 | 59.84 | 2.52 |
| C.D. (0.05) | 0.37 | 0.20 | 0.04 | 0.16 |
| SE.d | 0.17 | 0.09 | 0.01 | 0.07 |

**FWS**- Fresh weight of shoot; **DWS**- Dry weight of shoot; **DMC**-Dry matter content of shoot and **FSRR**- Fresh Shoot to root ratio.

There were significant differences observed between the treatments for dry matter production in this experiment. The dry matter production was higher in the treatment $T_3$ (66.50%) and lower in the control treatment (51.02%). Stella *et al.* (2013) reported that removal of endogenous auxin source, leads to a large increase in the cytokinin content of xylem exudates. This effect of auxin on cytokinin concentrations in the xylem suggests that auxin can influence apical dominance *via.*, inhibition of cytokinin synthesis or export from the roots (Coenen & Lomax, 1997). Amin *et al.* (2007) also reported that, foliar application with various concentration of IBA led to a significantly increase of dry matter content in onion.

There were significant differences observed between the treatments for fresh shoot to root production in annual Moringa (Table 2). The shoot to root production was higher in the treatment $T_3$ (3.23) and lower in the control treatment (1.71). The treatment $T_3$ was significantly different from other treatments. Two treatments exceeded the grand mean of 2.52. The fresh shoot to root ratio in the treatment with IBA 1500ppm was is 1.5 times higher than the control. Lupushinsky and Beebe (1976) also reported that proper shoot to root ratio is more important than top size alone. The present investigation revealed that new growth of both shoots and roots were higher in the higher auxin treated layers,

indicating the better portioning of the photo assimilates to form pronounced fibrous roots and earlier emergence of new shoots in the best treatment.

## CONCLUSIONS

From the above study it could be concluded that, coco peat with or without hormone has an impact to develop air layers in annual moringa. Air layering with 1500ppm of IBA increased the root length, root fresh weight, root dry weight, dry matter content of root, fresh weight of shoot, dry weight of shoot, dry matter content of shoot and fresh shoot to root ratio. Hence, the results of the present investigation imply that, IBA at 1500ppm concentration can be applied to produce air layers from annual moringa with better root and shoot characters for establishment of layers.

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